

# Game Change: the “ridge” in pp collisions

**Opportunity of studying novel QCD phenomena opened up by the LHC**

Two-particle  $\Delta\eta$ - $\Delta\phi$  correlation



September, 2010

PUBLISHED FOR SISSA BY SPRINGER

RECEIVED: September 22, 2010

ACCEPTED: September 23, 2010

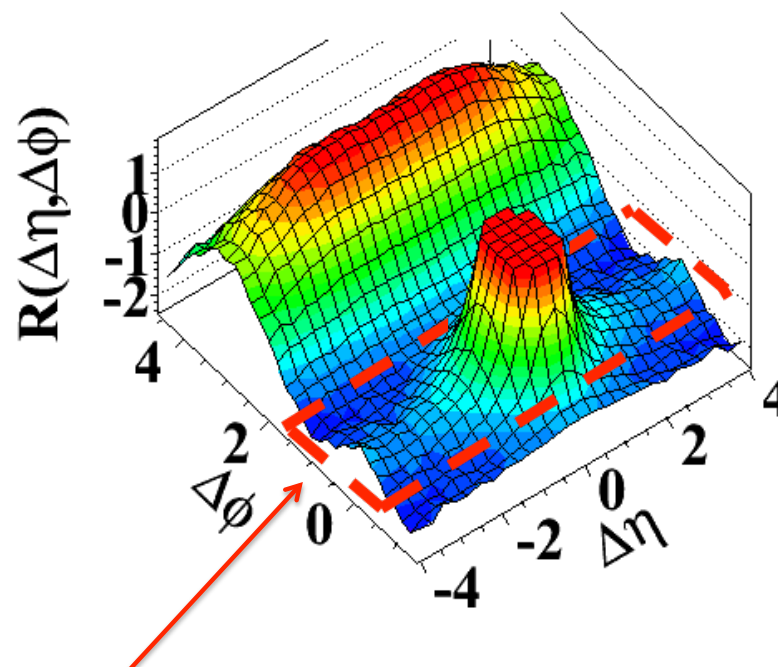
PUBLISHED: September 27, 2010

**Observation of long-range, near-side angular correlations in proton-proton collisions at the LHC**

The CMS collaboration

ABSTRACT: Results on two-particle angular correlations for charged particles emitted in proton-proton collisions at center-of-mass energies of 0.9, 2.36, and 7 TeV are presented, using data collected with the CMS detector over a broad range of pseudorapidity ( $\eta$ ) and azimuthal angle ( $\phi$ ). Short-range correlations in  $\Delta\eta$ , which are studied in minimum bias

pp  $N > 110$ ,  $1 < p_T < 3$  GeV/c

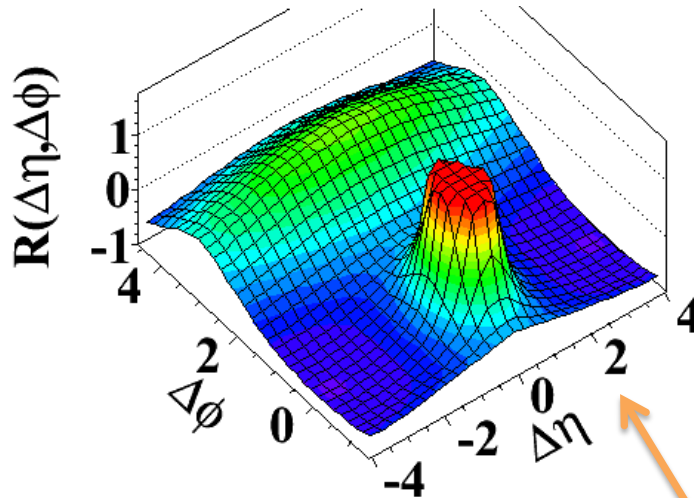


**Unexpected ridge-like correlations in high multiplicity pp!**

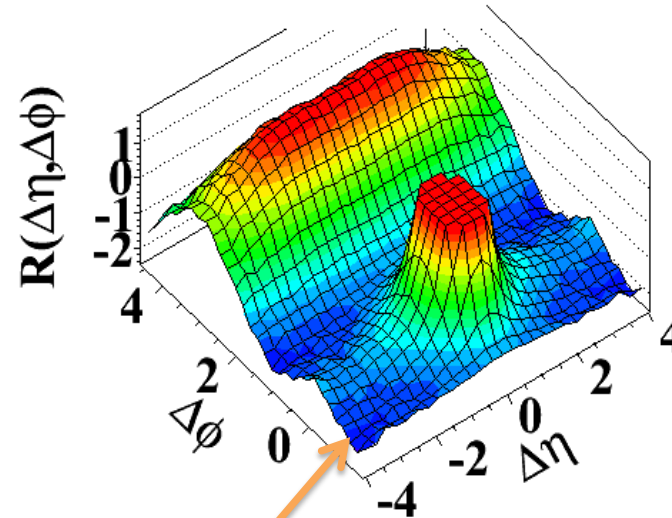
# High Multiplicity Events is the key!

Two-particle  $\Delta\eta$ - $\Delta\phi$  correlation

pp  $\langle N \rangle \sim 15$ ,  $1 < p_T < 3$  GeV/c

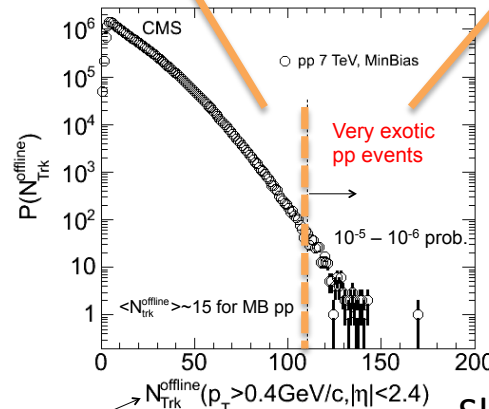


pp  $N > 110$ ,  $1 < p_T < 3$  GeV/c



High multiplicity trigger in FVTX is to be developed for Run15!

Very high-multiplicity pp events are rare in nature

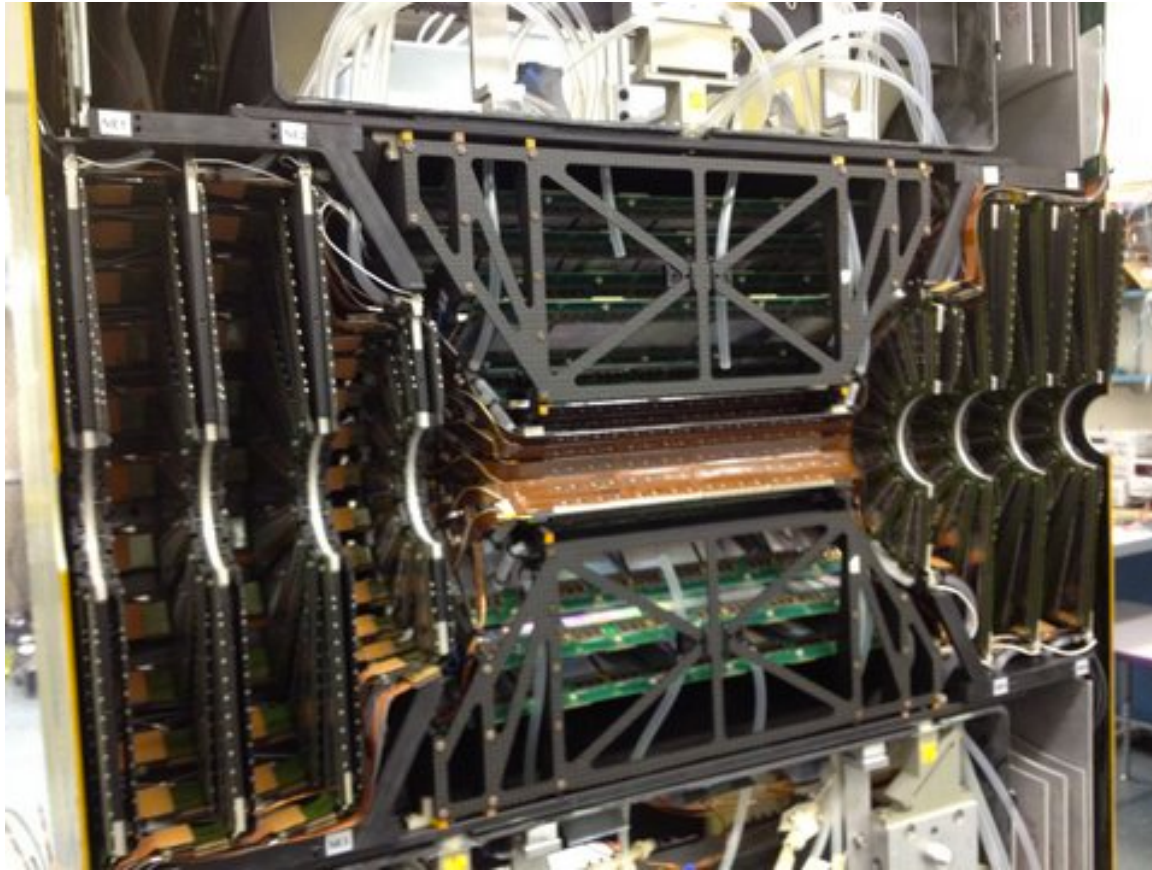


Raw counts of tracks!

110 tracks translated to be 20~30 tracks/arm in FVTX acceptance.

Slide from Wei Lei, Rice University

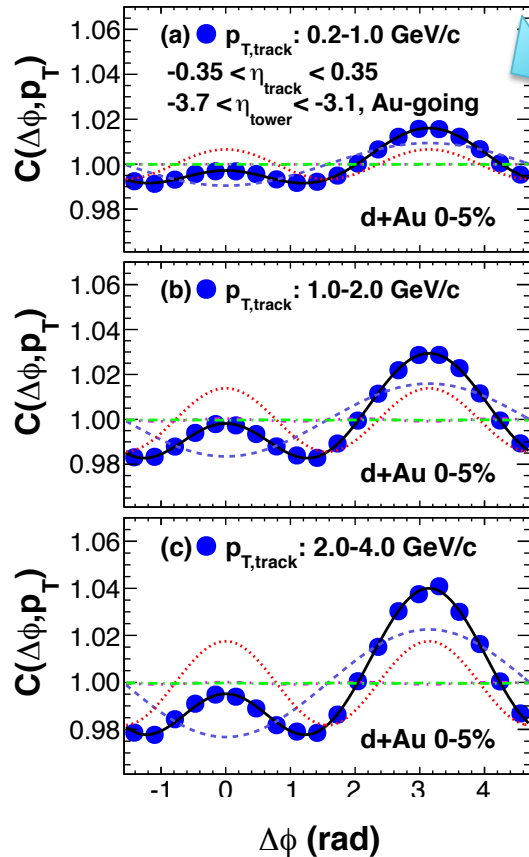
# Forward Vertex (FVTX) Detector



Implement New High Multiplicity Trigger Capability in Existing Readout Electronics for Run15 pp Run

# Yield Estimate

$V_2$  extraction from Run8 dAu  
Centrality 0-5% : **80Mevents**



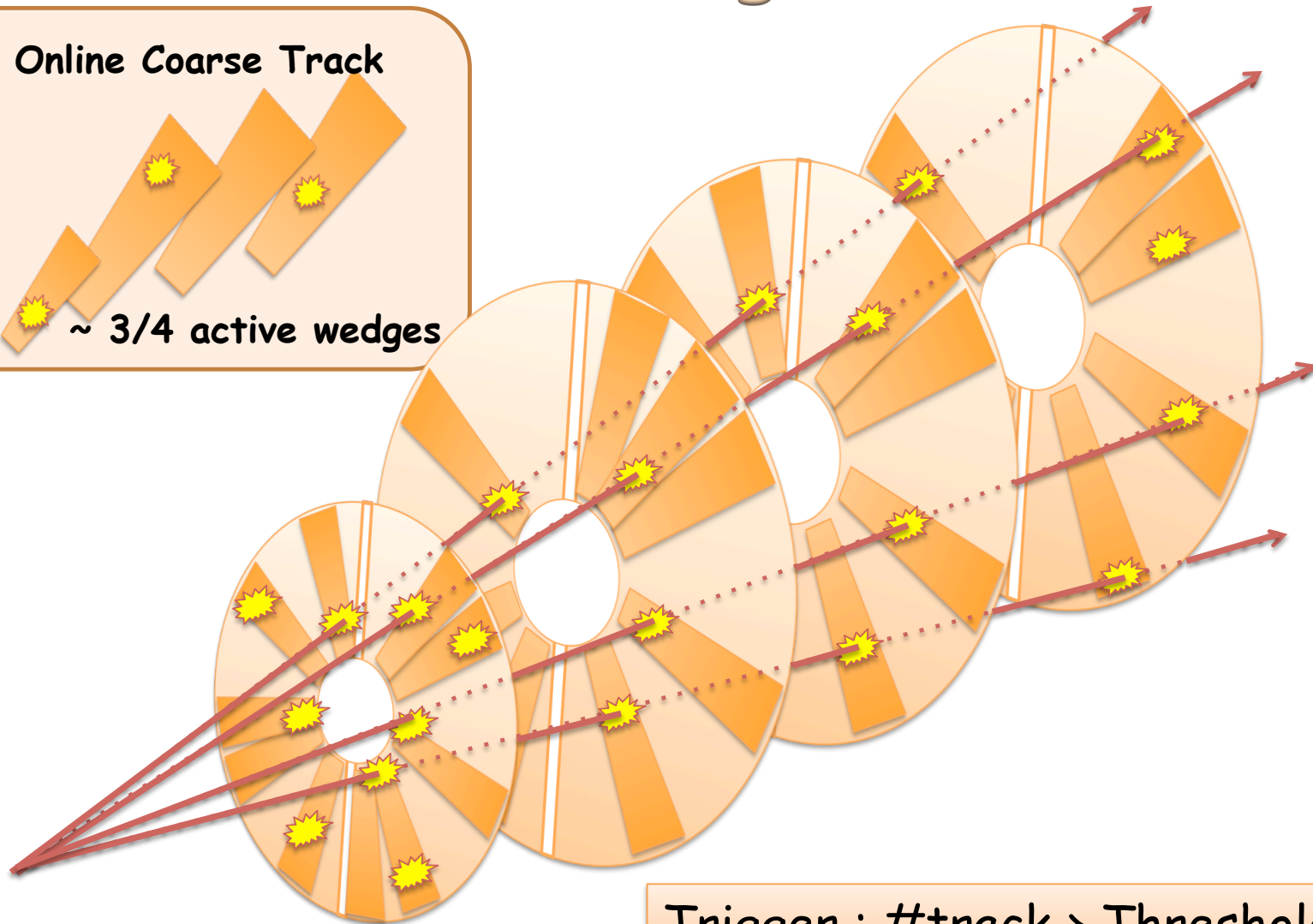
Run15 pp

100 Hz bandwidth for  
FVTX HighMulti Trigger

9 weeks of pp running  
assuming 30% uptime

**300 Mevents** to be  
accumulated  
(~ x4 of Run8 dAu central)

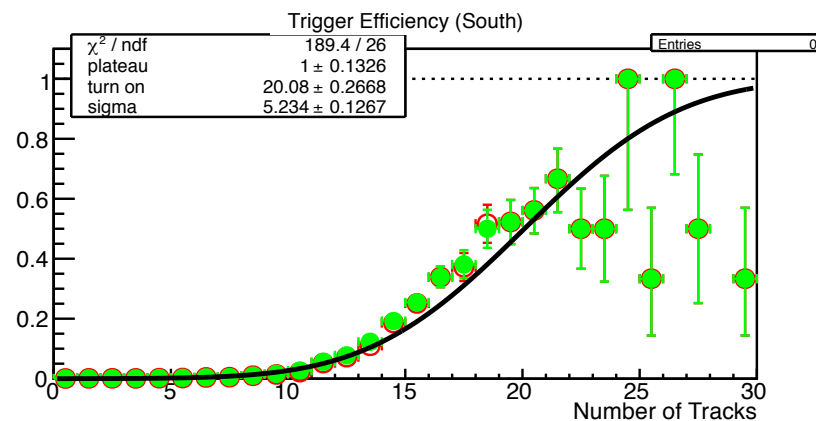
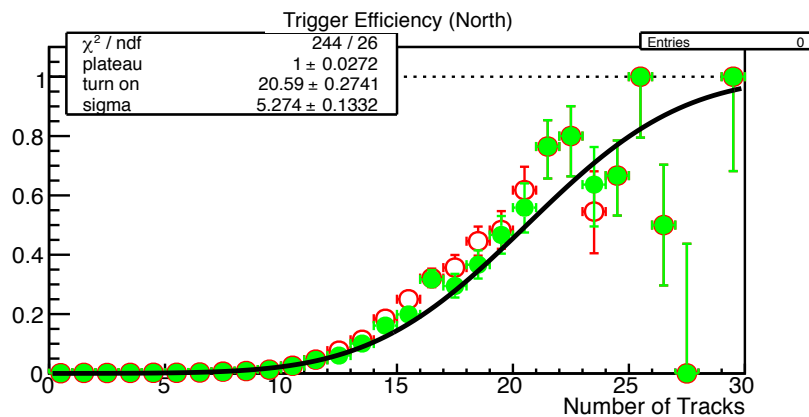
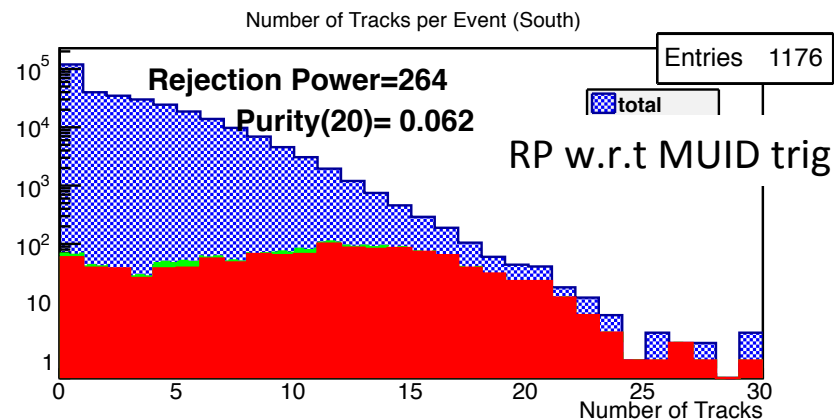
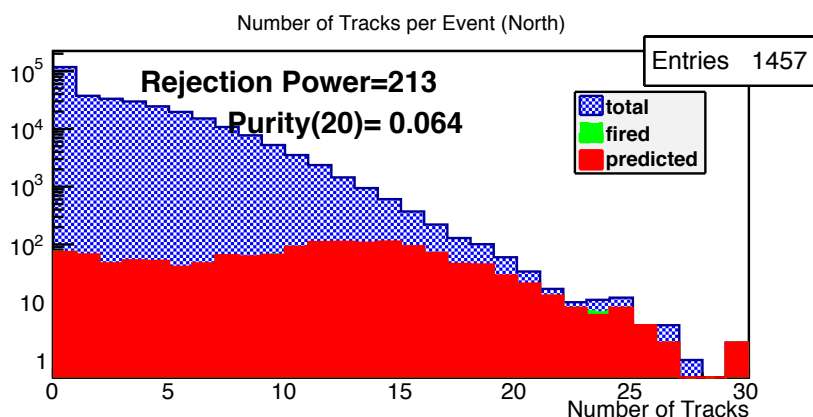
# Multi-Track Counting in Online



Trigger :  $\#track > \text{Threshold}$

# Trigger Performance

# track  $\geq 12/\text{arm}$



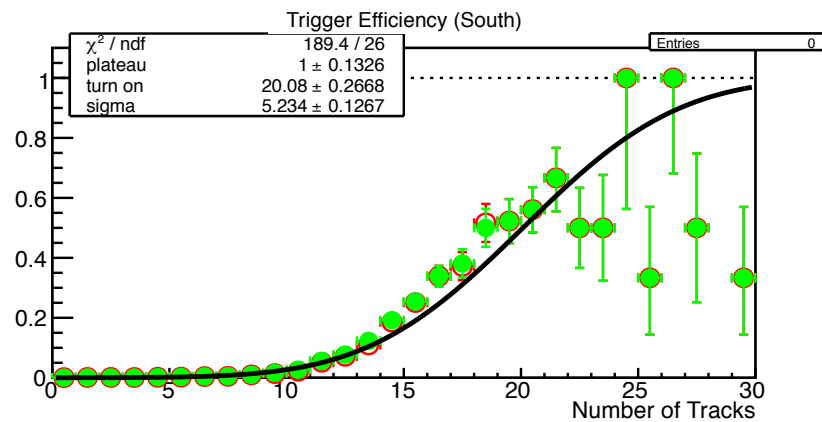
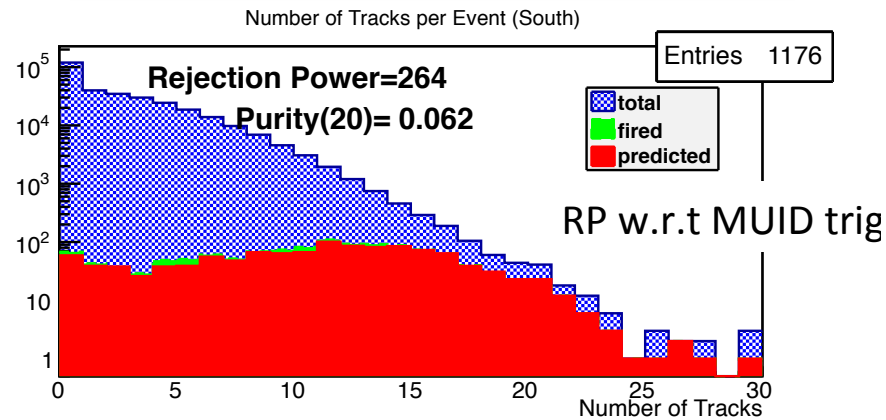
North

South



# Trigger Performance

# track  $\geq 12/\text{arm}$



South

